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THE SOUTHERN CORN LEAF-BEETLE.[1]

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INTRODUCTION.

The southern corn leaf-beetle (*Myochrous denticollis* Say) has become a pest of considerable importance during the last few years and has commanded the attention of entomologists on several occasions. Although the habits of this beetle are not fully known, it seems advisable to publish the known facts and suggest possible remedies.

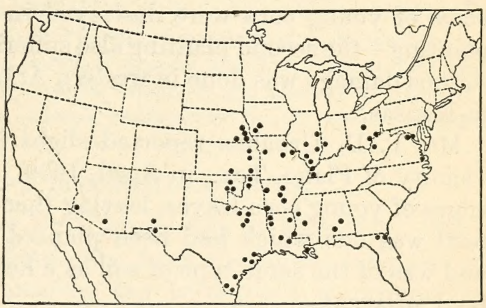

FIG. 1.—Map showing distribution of the southern corn leaf-beetle (*Myochrous denticollis*) in the United States. (Original.)

The writer's attention was first called to the destructive habits of these beetles in the summer of 1905, while investigating insects injurious to corn in southern Illinois. At that time numbers of adults were found feeding on grains of roasting ears in cornfields in the bottom lands of the Ohio River. Since being located by the Bureau of Entomology in southern Kansas the writer has watched this little beetle and as occasion offered made close investigation of its habits and life history. The occurrence of

[1] *Myochrous denticollis* Say; order Coleoptera, family Chrysomelidæ.

NOTE.—This bulletin is of especial interest to entomologists in the southern half of the United States.

numbers of beetles near Wellington, Kans., in 1910, and again in 1913, together with an outbreak in northern Texas in the spring of 1910, and in eastern Arkansas in 1913 and 1914, afforded material and opportunity for further extensive investigations.

Numbers of the larvæ have from time to time been found in the soil, always in close proximity to corn roots which were more or less eaten, but in no instance have they actually been observed feeding on corn roots, although especial attention has been given their feeding habits.

HISTORY.

In the Report of the Commissioner of Agriculture for 1887, Prof. F. M. Webster (Webster, 1887), then a special agent of the Division of Entomology, stated that beetles were observed in Louisiana during April in considerable numbers in fields of young corn. They were found in soil about the stems and attacking the young corn plants by gnawing the outside of the stems, without doing serious injury. His report on a later outbreak at Cheshire, Ohio, in 1900, was the first record of their having done serious damage (Webster, 1900). Since that time, however, they have been reported as having done serious injury at several points in Kansas, notably in the vicinity of Douglas, in 1905, as reported by E. S. Tucker (Tucker, 1905). The writer observed that they did considerable damage to young corn at Wellington, Kans., in 1910 and 1913, and severe damage in the neighborhood of Paris, Ark., in 1913, where several hundred acres of young corn were destroyed in early May, necessitating replanting—the second planting also suffering severely. Again, in 1914, serious damage was done in western Arkansas, but none was recorded in Kansas.

Mr. T. D. Urbahns reported slight injury to young corn in the vicinity of Plano, Tex., in April, 1909. The adults were cutting the edges of young corn leaves, leaving them quite ragged. The infested field was one which had been planted to cotton the previous year and was of the same type of soil as a heavy timbered stretch of black land adjacent.

Mr. Vernon King reported that the beetles had ruined several acres of young corn on farms near Charleston, Mo., in May, 1913, stating that the beetles were more numerous on black soil; in fact, none at all was found on light sandy soil. From one to four adults were observed on each plant and the plants were literally reduced to fragments. (See Pl. I, figs. 1 and 2.) The infested fields were those of recent clearing in bottom lands.

During April and early May, 1915, a second serious invasion of this species took place in this same locality. Mr. King having resigned, the second investigation was carried out by Mr. E. H. Gibson, who used the poisoned-bran bait with good success in destroying

the beetles, applying it about the hills of corn where the beetles were at work.

Observations in both Louisiana and Ohio by Prof. Webster (Webster, 1901) and in Kansas, Texas, and Arkansas by the writer seem to indicate that the insect occurs in destructive abundance on lands that have previously been devoted to pasture or lands that have been allowed to lapse into a semiwild condition, not having been cultivated for several years.

DISTRIBUTION.

The species is widely distributed over the southern half of the United States, extending from the extreme southeastern part of Arizona to southern Texas, becoming more numerous directly north of Brownsville, thence northward to southern Iowa, and eastward to northern Illinois and central Ohio and to Washington, D. C., the most southeastern point recorded being in northern Florida. This insect has not been reported from Tennessee, North Carolina, South Carolina, or Georgia, but evidently it may occur in these States. (See map, fig. 1.)

Prof. F. M. Webster (Webster, 1901) remarks in regard to the distribution of other species—

> *Myochrous squamosus* ranges from northern Arizona and New Mexico to the Platte River in Nebraska and northwest into Montana, probably through western South Dakota and Wyoming. *Myochrous longulus*, the only remaining species to be mentioned, is known to range from southern California and Arizona northward into Colorado, where it has been reported to Dr. Le Conte, without exact locality. It not unlikely occurs also in Utah, although it has not yet been reported from there in the literature, so far as I am able to learn, but in any case overlapping the territory inhabited by *Myochrous squamosus* in northern Arizona and New Mexico, and also probably in Colorado, while the latter species borders on and possibly mingles with *Myochrous denticollis* in southwestern Arizona, eastern New Mexico, western Kansas, and extreme southeastern Nebraska.

DESCRIPTION AND LIFE-HISTORY NOTES.

The insect was described by Dr. Thomas Say in 1824 (Say, 1824) under the name of *Colaspis denticollis*, from specimens collected in Missouri. Dr. Say did not mention any food plant in connection with his description. It was first described as an insect pest to growing corn by Prof. F. M. Webster (Webster, 1901).

THE EGG.

The egg (fig. 2) is small, oval, pale yellow, and about 0.036 of an inch in length and 0.015 of an inch in diameter. The surface is smooth and slightly glistening. The female deposits her eggs in clusters of from 10 to 50 in the field, carefully placing them in small pieces of weeds, hollow straws, in crevices, in clods of dirt, but always near corn plants.

Close searching in the neighborhood of plants other than corn has failed to reveal them, although the beetles have been noted feeding

on other plants at egg-laying time. In the laboratory, under artificial conditions, the eggs will hatch in from 6 to 10 days, rarely going as long as 15 days. Eggs have been observed from early April in northern Texas till the middle of May in Kansas.

THE LARVA.

The newly-hatched larvæ are nearly cylindrical, about 1 mm. long and 0.03 mm. in diameter, tapering slightly and becoming somewhat flattened toward the posterior extremity. They are pale yellow, except the first thoracic segment and head, which are creamy white. The head is a little broader than the thorax, and the body is covered with downy hairs. Within five days after the hatching the larvæ become a creamy white, which color is retained until maturity.

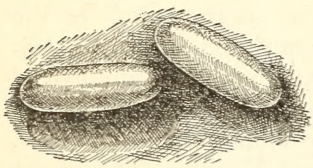

FIG. 2.—The southern corn leaf-beetle: Eggs. (Original.)

The mature larvæ (fig. 3) are 6 to 8 mm. in length and about 2 mm. in diameter. The head is slightly smaller than the thorax, the body becoming a little larger toward the anal extremity. The thoracic segments bear stout legs, and beginning with the second abdominal segment the next seven segments each bear a pair of ambulatory processes (fig. 3, *a*) which terminate in a long hair, accompanied by four shorter hairs. The anal plate (fig. 3, *b*) consists of five parts, which are very characteristic of this species and form a character which separates it from all other larvæ of the Eumolpini group.

During the last six years the writer and other members of the Bureau of Entomology have been making efforts to rear the larvæ of this species from egg to maturity, in order to determine definitely its food plant and exact life history. In the laboratory almost every form of receptacle has been used that could be devised, from a tiny vial with several kinds of food in it, fitted with blotting paper to absorb undue moisture, to flowerpots buried in the soil, which it was thought might simulate more natural conditions.

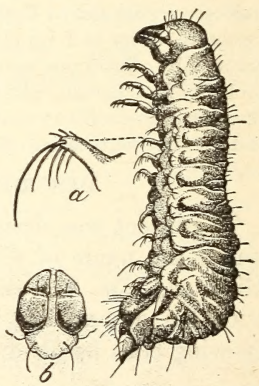

FIG. 3.—The southern corn leaf-beetle: Larva. *a*, Ambulatory process; *b*, anal plate. (Original.)

The list of growing plants involved in these experiments is as follows: Cocklebur (*Xanthium spinosum*), smartweed (*Persicaria hydropiper*), Japan clover (*Lespedeza striata*), crab grass (*Syntherisma sanguinale*), sorghum (*Sorghum vulgare*), alfalfa (*Medicago sativa*), cotton (*Gossypium* sp.), corn (*Zea mays*), wheat (*Triticum vulgare*), bluegrass (*Poa pratensis*), pigweed (*Chenopodium* sp.), and barnyard grass (*Echino-*

chloa crus-galli). Kernels of wheat and corn which had been soaked in water, pieces of decaying straws, corn pith, and toadstools were also tried, with negative results.

A few larvæ, fed on a combination of decaying corn pith and growing cornroots, failed to mature, probably for other reasons than lack of proper food, but were sufficiently large for use in identifying those collected in the field.

Numerous searches have been made in cornfields, wheat fields, grass, and fields grown up with weeds, and the larvæ have not yet been found feeding on plants other than corn. Larvæ have been found in the soil in cornfields where cocklebur and corn plants were growing together, and where corn was growing alone, but in no other situation.

The first larvæ found in the field were observed by Mr. T. H. Parks and the writer at Wellington, Kans., on July 20, 1910, in small round earthen cells from 4 to 6 inches deep, with a tiny burrow leading toward the cornroots, which had been more or less eaten. The larvæ hastily retreated to safety and feigned death when disturbed. By way of further determining this habit, a larva was allowed to crawl on the surface of the soil, when on suddenly jarring the soil several inches from it it hastily retreated and "folded up." Although a diligent search was made for feeding larvæ during the following days of July and up until the middle of August, none was found, though numbers of larvæ were unearthed.

The field in which the larvæ were first found is the dark waxy second bottom land which becomes very gummy and sticky during wet weather and very hard during dry weather. The outbreaks and damage reported by Prof. Webster, Mr. Tucker, and Mr. King and those observed by the writer in Kansas, Texas, and Arkansas have all been on soil of this character. In sandy or light soils very few larvæ or pupæ have been found and correspondingly few injured cornroots have been observed.

From the laboratory notes made at Brownsville, Tex., latitude 26°, by Mr. R. A. Vickery, it appears that the larval period probably extends from about April 1 to about June 15, while the writer's observations at Plano, Tex., latitude 33°, and at Paris, Ark., latitude 35°, show that the larval period ranges from April 15 to July 1, and at Wellington, Kans., latitude 37°, from May 1 to July 15.

In the bottom lands of the Arkansas River, near Paris, Ark., the larvæ had pupated and practically all the adults had issued by July 22, 1914, indicating that they began pupating as early as July 1. In the vicinity of Wellington, Kans., the larvæ began to pupate about the middle of July, pupæ being found as early as July 20 and as late as August 14. The period for maturing the pupa seems to be about 15 days, although no exact data have been obtained.

THE PUPA.

The first pupæ (fig. 4) to be found were in earthen cells in the soil near corn plants at depths of from 4 to 6 inches. The finding of pupæ which were nearly mature at this time, some of which changed to adults by the next morning, indicated that the larvæ had finished feeding and were in their pupal cells.

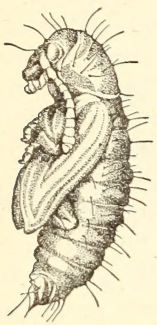

FIG. 4.—The southern corn leaf-beetle: Pupa. (Original.)

The pupa is white until within one day of maturity, when it begins to darken.

In dorsal view the head is bent ventrad; the bristles on the head are prominent and irregularly placed in a double row on the median dorsal line; there is a single row of setæ above the plural suture; the eighth abdominal segment has a semicircular row of setæ and the anal segment is supplied with a stout, curved spine; each abdominal segment bears several stout setæ on the dorsum. In lateral view the body is longer than wide, tapering from the fifth abdominal segment; the antennæ are directed dorsad around the femora of the two front pairs of legs, thence backward with the tips lying near the claws of the middle legs and on top of them; the elytra and wings are rather short, thick, tapering toward the tip, and folded over the posterior legs, the tarsi of which reach the eighth segment. In ventral view the head is as long as the thorax, directed forward, with the front lying between the tarsi of the front pair of legs; the elytra and the tarsi nearly meet ventrally, forming a deep ventral groove. The pupa is 5 to 6 mm. long and from 3 to 3.5 mm. wide.

THE ADULT.

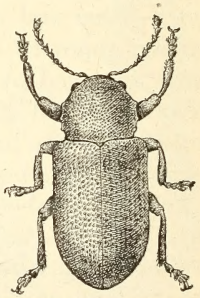

FIG. 5.—The southern corn leaf-beetle: Adult. (Original.)

To the average farmer the beetles (fig. 5) can be recognized as small, dark brownish beetles, more or less covered with bits of soil. They are about three-sixteenths of an inch long and about one-third as wide. They have the habit of dropping from their food plant to the ground and hiding when disturbed, and owing to this habit they are very rarely seen. Quite often farmers have noticed seriously damaged young corn, the plants being literally in fragments, and have been unable to locate the cause on account of this habit of the beetles of dropping to the ground and hiding. It is sometimes difficult even for trained entomologists to locate them.

Dr. Thomas Say (Say, 1824) described the adult as follows:

Body black, slightly bronzed, covered with dense, robust cinereous hairs; antennæ dull rufous at base; thorax with three equal, equidistant teeth on the lateral edge; elytra, lateral edge minutely dentated; tip simple; anterior tibiæ and posterior thighs one-toothed. Length, nearly one-fifth of an inch.

The beetle seems to prefer to feed early in the morning, late in the evening, or at night, or on cloudy days; very rarely it feeds during the heat of the day, and at this time of the day it is generally found under clods of dirt or down beneath the leaves of the plants.

HIBERNATION.

The adult beetles issue from pupal cells about the middle of July in central Arkansas and the 1st of August in southern Kansas, emergence extending over a period of about one month. They do considerable feeding on the kernels of unripe ears of corn and buds of cocklebur before entering hibernation, which begins early in the fall. They have been observed by Mr. W. R. McConnell hibernating under piles of corn husks, in fodder shocks, in cornfields, and also in clumps of *Andropogon scoparius*, *Andropogon virginicus*, and *Cyperus rotundus*. Mr. A. H. Rosenfeld (Rosenfeld, 1911) found one adult hibernating in Spanish moss (*Tillandsia usneoides*).

Adults were found in hibernation in the fall of 1913 throughout bottom-land cornfields near Paris, Ark., these being the same fields that had been devastated the previous spring. In a large cotton field adjacent to one of these cornfields beetles were found in large numbers under piles of rubbish, in the open unpicked cotton bolls, and a large number were found lying on the ground beneath a large pile of recently picked cotton.

While investigating the hibernation of this insect in central Arkansas the writer's attention was called to a cotton gin from the dirt spout of which the beetles were being shaken from cotton which was then being brought in from the fields for ginning. A double handful of living beetles were thus collected in a short time. The manager of the cotton gin informed the writer that he had been noticing these beetles since early fall and that they were more numerous in late November. This cotton gin was located in the Arkansas River bottoms and only such cotton as was grown in the immediate vicinity was ginned.

After leaving this locality, the writer visited a gin located near the edge of the foothills, where both hill-land cotton and bottom-land cotton were being ginned. The bottom-land cotton produced a few beetles, but the upland cotton was apparently free from them. In the town of Paris, two large cotton gins were visited and searched for this beetle, but owing to the fact that most of the cotton they were receiving at this time was from the hill land, none of the beetles could

be found. However, in the pile of rubbish and dirt at the side of the gin which had been thrown from the dirt auger several fragments of dead beetles were found. The manager of this gin could not give any information regarding the occurrence of the beetles. He had noticed, however, some large brown cases which occurred rather numerously early in the fall, probably the pupal cases of the cotton leaf-worm (*Alabama argillacea* Hübn.).

CROPS DAMAGED.

Corn is the only cultivated crop that has been known to be attacked in sufficient numbers to cause serious damage. The beetles, upon first emerging from hibernation in the early spring, attack very young cocklebur and early volunteer corn, the crop not having been planted at that time.

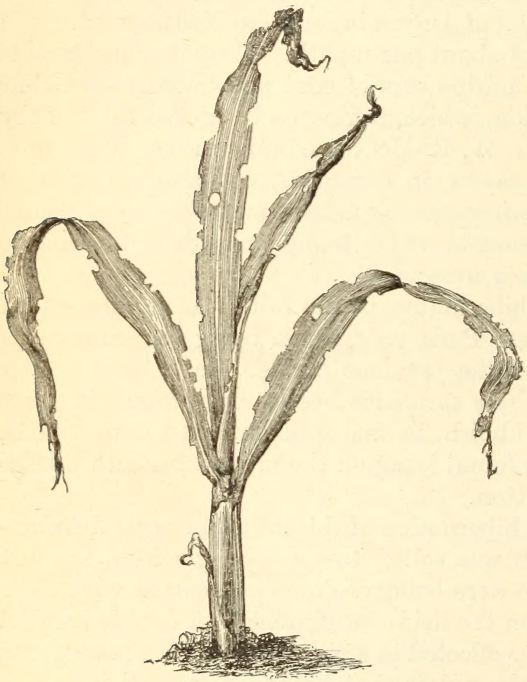

FIG. 6.—Young corn plant showing work of adult of the southern corn leaf-beetle. (Original.)

Besides corn, the beetles have been observed by the writer to attack the young leaves and growing shoots of cocklebur, smartweed, Japan clover, and crab grass. Mr. Vickery has observed them feeding on sorghum and alfalfa—on the latter plant, however, only in rearing cages in the laboratory. Mr. W. R. McConnell has found them feeding on sorghum in the field and also on *Alopecurus geniculatus*. Some of the agents of the branch of Southern Field Crop Insect Investigations have observed them feeding on the cotton plant.

The ragged appearance of the corn plant (fig. 6) is indicative of their presence, especially the notched edges of the leaves, and where the beetles appear in sufficient numbers to devastate a field these notches become so numerous that the plant dies. (Pl. II.) The early planting seems to be the one most seriously affected, although the second planting on the farm of a Mr. Baskins and on other farms near Paris, Ark., was about 50 per cent damaged in 1913, the

FIG. 1.—CORNFIELD DEVASTATED BY ADULTS OF THE SOUTHERN CORN LEAF-BEETLE. (FROM WEBSTER.)

FIG. 2.—CORNER OF SAME FIELD AFTER SECOND PLANTING. (FROM WEBSTER.)

WORK OF THE SOUTHERN CORN LEAF-BEETLE (MYOCHROUS DENTICOLLIS).

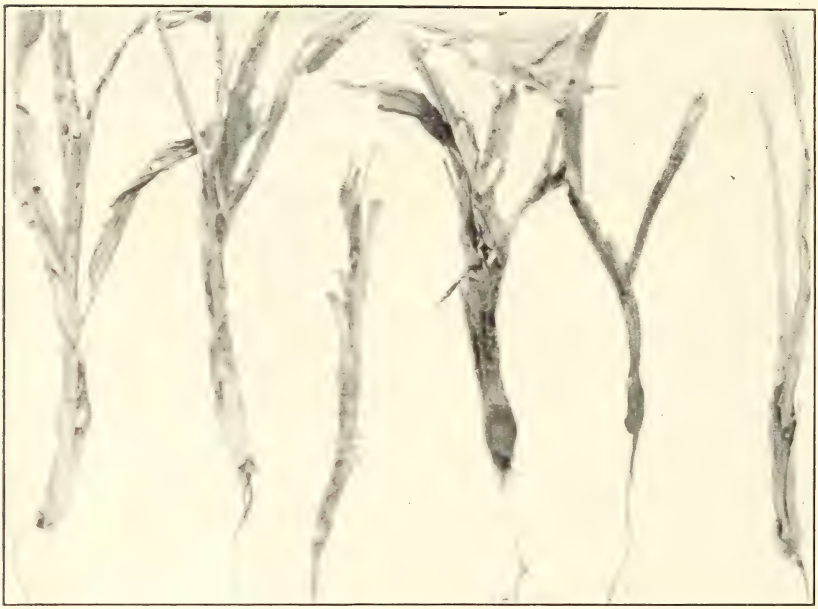

FIG. 1.—YOUNG CORN PLANTS KILLED BY ADULTS OF THE SOUTHERN CORN LEAF-BEETLE. (ORIGINAL.)

FIG. 2.—CORN PLANT COMPLETELY DESTROYED BY THE SOUTHERN CORN LEAF-BEETLE. (ORIGINAL.)

WORK OF THE SOUTHERN CORN LEAF-BEETLE.

first planting having been entirely destroyed. The devastation of 1914 was very severe but not so heavy as in 1913.

Considerable search on cotton and wheat growing in the vicinity of infested cornfields near Paris, Ark., developed no damage to these crops.

DISSEMINATION.

The beetles have powerful wings and have been observed in fields long distances from where they originated. Especially was this true in one instance, during the fall of 1910, where it was positively known that they developed in certain bottom-land fields, later migrating 2 miles to a field of late upland corn, where great numbers of them were found feeding upon the belated ears. In this last-mentioned field the farmer planted wheat and in the operation the drill raked up piles of the corn leaves, among which great numbers of the beetles hibernated during the following winter. Counts made the following spring, before they left hibernating quarters, indicated that about 80 per cent of these beetles survived the winter. A lot of the dead beetles were kept for parasites, but no parasites developed. From these hibernating quarters beetles emerged in this same field in late March, after the weather had become warm. They were noticed flying in a northerly direction, though just where they went could not be determined.

It does not seem to the writer that an outbreak of this insect is brought about by the growing of any particular crop on a certain field, but it would appear that an outbreak is very likely to follow where a field has been allowed to lie idle, especially so if allowed to grow cocklebur and volunteer corn for a year or more and to become very weedy and foul, thus affording hibernating quarters.

The fact that adults have been found hibernating in grasslands, in which situation larvæ have never been found, indicates that they do not necessarily hibernate in the field in which they breed, and furthermore that they do fly away from their breeding grounds.

REMEDIES.

A great number of beetles have been taken at lights, which would indicate that a powerful light trap situated in the vicinity of the infested field might materially reduce them. In the early fall, when they are flying in search of hibernating quarters, it is possible that the light trap would catch large numbers.

Judging from the conditions of fields in which they have been observed hibernating in large numbers, the cleaning up of all rubbish in the cornfields early in the fall, especially in fields for very late corn, would prove an effective remedy as a protection for the succeeding crop. The fact that large numbers were observed in the vicinity of cotton gins would suggest that the managers of cotton gins might use

their rubbish and trash for boiler fuel and thus destroy a great number of the beetles.

Ordinarily the beetles attack a field of corn when it is very young and destroy it before the farmer becomes aware of their presence. No remedy has been found that can be recommended in combating them after they enter the cornfield. If the crop is so badly damaged as to be worthless it can be replanted with safety from damage by this insect about one month after the regular planting time. Within a few days after they have killed out the first planting they will leave the field, thus making it safe to replant.

From all the writer has been able to observe or learn the beetles leave their hibernating quarters in early spring, depositing their eggs about young corn plants as soon as these are available for their purpose. It would also appear that the season of oviposition is prolonged and that it is these overwintering beetles that feed upon and destroy the corn plants while thus engaged. This would lead to the somewhat anomalous assumption that the parent beetle under stress of hunger destroys the food plant of the larvæ, which if true would account for the very erratic occurrence of the outbreaks of this pest.

As an additional suggestion, the fact that the beetles appear and disappear with considerable regularity from south to north, taken together with the fact that corn planted three or four weeks after the usual planting season has escaped attack of the beetle, would indicate that something might be gained by delaying corn planting in localities where beetles have been injurious the previous year.

Mr. E. H. Gibson, in his experimental work with this species in the vicinity of Charleston, Mo., during late April and early May, 1915, reports having found that, after repeated trials under varying conditions, carried out with check experiments, the beetles can be readily destroyed by a poisoned-bran bait, consisting of 25 pounds of wheat bran, 1 pound of Paris green, 1 gallon of low-grade molasses, and the juices of 3 oranges, with enough water to bring the mixture to a stiff dough. The best success in the use of this poisoned bait was obtained when applied in the late afternoon. It would seem that this measure might be an extremely practical one if applied to the restricted areas from which the beetles frequently spread, the bait being scattered lightly on the ground among the plants where the beetles are at work.

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